Table of Contents

Section 1
Introduction ........................................................................................................... 1-1
1.1 Overview ...................................................................................................... 1-1
1.2 AT88CK109STK Starter Kit Features ........................................................ 1-1

Section 2
Getting Started ................................................................................................. 2-4
2.1 Unpacking the System .............................................................................. 2-4
2.2 System Requirements .............................................................................. 2-4
2.3 Software Installation ............................................................................... 2-4

Section 3
Using the AT88CK109STK ............................................................................. 3-5
3.1 Overview ...................................................................................................... 3-5
3.2 Power Supply ............................................................................................. 3-6
3.3 RESET ......................................................................................................... 3-7
3.4 AT90USB1287 AVR Microcontroller ............................................................ 3-8
3.5 Serial Links .................................................................................................. 3-8
3.6 On-board Resources .................................................................................. 3-9
3.7 AT88CK109BK3 CryptoAuthentication Daughter Board ............................ 3-12
3.8 AT88CK109BK3 HOST and CLIENT Sockets Compatibility ..................... 3-12
3.9 HOST and CLIENT Power Configuration ..................................................... 3-13
3.10 Devices Interconnect Header .................................................................... 3-14
3.11 Mapping AT88CK109BK3 to AT88Microbase, STK500 and STK600 ......... 3-14
3.12 Interfacing a USART with CryptoAuthentication ....................................... 3-16
3.13 In-System Programming ........................................................................ 3-16
3.14 Debugging ................................................................................................... 3-17
3.15 Test Points .................................................................................................. 3-18

Section 4
Troubleshooting Guide ..................................................................................... 4-1

Section 5
Technical Specifications .................................................................................... 5-1

Section 6
Technical Support ............................................................................................. 6-1

Section 7
Complete Schematic ......................................................................................... 7-1
Section 1
Introduction

Congratulations on acquiring the AVR®-based AT88CK109BSTK3 CryptoAuthentication Starter Kit. This kit is designed to give designers a quick start to develop code for the CryptoAuthentication product family. All the necessary hardware is provided in the package. The AT88Microbase has been pre-programmed for your convenience. Please be sure to visit WWW.Atmel.com/Javan for the latest firmware image.

1.1 Overview

This document describes the AT88CK109STK3, which is a development kit for the AT88SA100, AT88SA102, and AT88SA108 CryptoAuthentication devices. This kit uses a modular approach. The development kit includes the AT88Microbase board and the AT88CK109BK3 CryptoAuthentication daughter board. The AT88Microbase uses a convenient Type-A USB interface allowing users to interface with a personal computer and experiment with CryptoAuthentication. The small USB form factor of the AT88Microbase allows the board to function as a demo as well as a development platform.

The AT88CK109BK3 daughter board has two SOT23-3 sockets for either client-host or multiple client development. Together, these boards allow an easy evaluation of the CryptoAuthentication products using demonstration software. This user guide acts as a general, getting started guide as well as a complete technical reference for advanced users.

1.2 AT88CK109STK3 Starter Kit Features

AT88Microbase provides the following features:

- AT90USB1287 (AVR) 64 QFN device (2.7V < VCC < 5.5V)
  - 128K Bytes of In-System Self-Programmable Flash
  - 4K Bytes EEPROM
  - 8K Bytes Internal SRAM

- AT88SC018 CryptoCompanion IC

- USB software interface for Device Firmware Upgrade (DFU boot loader)(2)

- Power supply LED
  - from the USB interface (USB device bus powered application)
  - from an external power supply

- JTAG Connector:
  - for on-chip ISP
  - for on-chip debugging using JTAG ICE
Serial interfaces:
- 1 USB full / low speed device interface
- UART

On-board resources:
- 3 User defined LEDs
- 10 Pins I/O header (2x5, 0.1” pitch)
  - Supports SPI, TWI, and UART
- 1 Buzzer

On-board RESET button

On-board HWB button to force AVR into DFU mode at reset

16 MHz crystal for system clock

The AT88SC19BK3 provided the following features:

- 2 SOT23-3 CryptoAuthentication Sockets
  - HOST and CLIENT
  - Software PWR control
- AVR Studio® software interface(1)

Notes: 1. AT88Microbase is supported by AVR Studio®, version 4.17 (build 666) or higher. For up-to-date information on this and other AVR tool products, please consult our web site. The newest version of AVR Studio®, AVR tools and this User Guide can be found in the AVR section of the Atmel web site, http://www.atmel.com.

2. ATMEL Flip®, In System Programming Version 3.2.2 or higher shall be used for Device Firmware Upgrade. Please consult Atmel web site to retrieve the latest version of Flip and the DFU bootloader Hex file if needed
1.2.1 Device Support

AT88CK109BK3 (daughter board) currently supports the following CryptoAuthentication devices:

- ATSA88100
- ATSA88102
- ATSA8810HS

Section 2
Getting Started

2.1 Unpacking the System

Package content:
- AT88Microbase Controller
- AT88CK109BK3, CryptoAuthentication daughter board
- Atmel CryptoAuthentication product assortment
- 1 USB cable, 6 inches

2.2 System Requirements

The minimum hardware and software requirements are:
- 200 MB free hard disk space (AVR Studio, FLIP and ATMEL’s Crypto Evaluation Studio)
- Windows® XP, X86 processor
- Available USB Port

2.3 Software Installation

- Install CryptoAuthentication Demonstration Utility available from WWW.Atmel.com/Javan
- Launch software and follow the online help.

Note: The CryptoAuthentication IC’s that are included with your kit have Development Secrets, not Production secrets. See the .xml file that is included with the CryptoAuthentication utility. Please be aware of this during your development.
This chapter describes the features of the AT88Microbase and the AT88CK109BK3 boards.

3.1 Overview

Figure 2. AT88Microbase Components (front side)
3.2 Power Supply

3.2.1 USB powered

The on-board power supply circuitry allows two possible configurations for the main supply voltage.

<table>
<thead>
<tr>
<th>Mounted Resistor</th>
<th>Main Board Supply Voltage</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>3.3V</td>
<td></td>
</tr>
<tr>
<td>R2</td>
<td>5.0V ( USB )</td>
<td>Default Setting</td>
</tr>
</tbody>
</table>

The CryptoCompanion supply voltage is always 3.3V, regardless of R1 and R2 configuration.
Note 1: For the AT88SA100, AT88SA102, and the AT88SA10HS devices, 5.0V is required to burn the fuses.

Note 2: The AT88Microbase is shipped with a 16MHz crystal, which allows the AT90USB1287 on-chip USART to obtain the 230.4K baud rate (-3.5% error) required to communicate with a CryptoAuthentication device. The 16MHz crystal requires that \(4.5 \leq VCC \leq 5.5\). To operate the AT88Microbase below 4.5V, the 16MHz crystal must be replaced with an 8MHz crystal. The **ABM3B-8.000MHZ-B2-T** 8MHz crystal is a drop-in replacement.

### 3.2.2 Power LED, "LEDP"

The blue LED (LEDP) is always lit when power is applied to the AT88Microbase regardless of the voltage supply.

*Figure 4. Power on LED "LEDP"*

### 3.3 RESET

Although the AT90USB1287 has its on-chip RESET circuitry, (c.f. AT90USB1287 Datasheet, section “System Control and Reset”), the AT88Microbase provides two additional means to reset the AT90USB1287.

#### 3.3.1 Power-on Reset

The on-board RC network acts as power-on RESET.

#### 3.3.2 RESET Push Button

By pressing the RESET push button on the AT88Microbase, a warm RESET of the AT90USB1287 AVR is performed.

*Figure 5. RESET Push Button (AVR RESET) Implementation*
3.4 AT90USB1287 AVR Microcontroller

To use the USB interface of the AT90USB1287, the clock source should always be a crystal or an external clock oscillator (the internal 8MHz RC oscillator cannot be used to operate the USB interface). Only the following crystal frequencies allow proper USB operations: 2MHz, 4MHz, 6MHz, 8MHz, 12MHz, and 16MHz. The AT88Microbase comes with a default 16MHz crystal oscillator, which is required to obtain the 230.4K USART baud rate needed for CryptoAuthentication communication.

3.5 Serial Links

3.5.1 USB

The AT88Microbase is supplied with a standard USB Type-A receptacle. The AT88Microbase only operates as an "USB device".

Figure 6. USB Type-A Receptacle

3.5.2 USART

The AT90USB1287 AVR comes with an on-chip USART peripheral (USART1). Only the asynchronous mode is supported. See section 3.6.3 for pinout details.

3.5.3 SPI / TWI Selector Switch

The SPI – TWI selector switch (K1) allows either the SPI pins (MOSI and SCLK) or the TWI pins (SDA and SCL) to be routed to the 10 pin Interface header, J1. See section 3.6.3 for pinout details.

Figure 7. TWI – SPI Selector Switch
3.6 On-board Resources

3.6.1 Description of LED Bank

The AT88Microbase includes 3 general purpose red LEDs, which are connected to PD6, PD5 and PD4. To light an LED, the corresponding port pin must be driven high. To turn off an LED, the corresponding port pin must be driven low.

Figure 8. LEDs Implementation Schematic

Note: AVR can source or sink enough current to drive an LED directly.

3.6.2 Buzzer

The small onboard buzzer adds audio capability to the AT88Microbase board. The buzzer requires that PD7 be driven with a square wave at $4.0 \pm 0.5$ KHz to achieve a maximum decibel of 78dB.
Brief Spec:

- **Input Signal:** Square Wave
- **Resonant frequency:** $4.0 \pm 0.5\, \text{KHz}$
- **Sound Pressure Level:** 78dB

### 3.6.3 Description of the Interface Header

The 10-Pin header (J1) of the AT88Microbase provides interfacing for daughter boards.

*Figure 10. 10-Pin Interface Header*
3.6.4 CryptoCompanion Chip

The AT88Microbase has one CryptoCompanion device (AT88SC108), which is located on the back side of board. The AT88SC018 is designed as the mate to Atmel’s CryptoRF® (CRF) and CryptoMemory® (CM) chips. The SCL and SDA pins are connected to PD0 and PD1, respectively. The RST and PDN pins are connected to PF2 and PF3, respectively.

Note: The CryptoCompanion chip cannot be used with the CryptoAuthentication family of devices.
The following sections 3.7 – 3.11 describe the AT88CK109BK3 CryptoAuthentication daughter board.

### 3.7 AT88CK109BK3 CryptoAuthentication Daughter Board

*Figure 13. AT88CK109BK3 Components (top side)*

AT88CK109BK3 has two SOT23-3 sockets that support the AT88SA100, AT88SA102, and the AT88SA10HS 3-leads devices.

*Figure 14. Chip-in-Socket Placement (Live bug)*

### 3.8 AT88CK109BK3 HOST and CLIENT Sockets Compatibility

AT88CK109BK3 is supplied with two SOT23-3 sockets titled HOST and CLIENT. Since both sockets have identical pinout’s, the AT88Microbase can physically accept a host or a client device in either socket. Therefore, the AT88CK109BK3 can be configured for either a host-client or client-client development.
3.9 HOST and CLIENT Power Configuration

The AT88CK109BK3 provides the user with the capability to independently power cycle each socket with software or place the sockets in a constant power-on state, assuming power is applied to the board.

**Figure 15. HOST and CLIENT Power Headers**

**Figure 16. Schematic Implementation for Software Power Control, HOST-side**

<table>
<thead>
<tr>
<th>Jumpers Position</th>
<th>Comments</th>
<th>View</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware Power Configuration</td>
<td>With all 4 jumpers mounted, the HOST and CLIENT sockets are placed into a constant power-on state. *Default setting</td>
<td>![View Diagram]</td>
</tr>
</tbody>
</table>
3.10 **Device Interconnect Header**

The "INTERCONNECT" header provides a single-wire bus between the signal pins of the HOST and CLIENT devices. The header can also serve as test points.

*Figure 17. Interconnect Header*

![Interconnect Diagram](image)

Maps to AT88Microbase PB7

Maps to AT88Microbase PB6

3.11 **Mapping AT88CK109BK3 to AT88Microbase, STK500 and STK600**

The AT88CK109BK3 maps to the 10-pin header of the AT88Microbase as follow:

*Table 2. Mapping the AT88CK109BK3 to the AT88Microbase*

<table>
<thead>
<tr>
<th>AT88Microbase Header ( J1 )</th>
<th>AT88CK109BK3</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>PB0</td>
<td>PB0</td>
<td>Software Power Control HOST Socket</td>
</tr>
</tbody>
</table>

HOST
Software Power Configuration
H1 Mounted
H2 Not - mounted

This configuration allows the user to power cycle the HOST socket via software. See Table 2 and 3 for pinout details

CLIENT
Software Power Configuration
H3 Mounted
H4 Not - mounted

This configuration allows the user to power cycle the CLIENT socket via software. See Table 2 and 3 for pinout details
Table 3. Mapping AT88CK109BK3 to the STK500 and STK600

<table>
<thead>
<tr>
<th>STK500 / STK600</th>
<th>AT88CK109BK3</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Px0</td>
<td>NC</td>
<td>-</td>
</tr>
<tr>
<td>Px1</td>
<td>NC</td>
<td>-</td>
</tr>
<tr>
<td>Px2</td>
<td>Tied to Px3 with R11¹</td>
<td>USART (Receive)¹</td>
</tr>
<tr>
<td>Px3</td>
<td>CLIENT Signal Pin</td>
<td>Bit-banging / USART (Transmit)¹</td>
</tr>
<tr>
<td>Px4</td>
<td>HOST Signal Pin</td>
<td>Bit-banging</td>
</tr>
<tr>
<td>Px5</td>
<td>Software Power Control</td>
<td>HOST Socket</td>
</tr>
<tr>
<td>Px6</td>
<td>Software Power Control</td>
<td>CLIENT Socket</td>
</tr>
<tr>
<td>Px7</td>
<td>NC</td>
<td>-</td>
</tr>
<tr>
<td>GND</td>
<td>GND</td>
<td>GND</td>
</tr>
<tr>
<td>VCC</td>
<td>VCC</td>
<td>VCC</td>
</tr>
</tbody>
</table>

¹ See section 3.12

Note 3: “x” in Table 3 denotes any port on the STK500 and STK600
3.12 Interfacing a USART with CryptoAuthentication

A microcontroller's USART requires a minimum of two signals (RXD and TXD) to communicate. The AT88SA100, AT88SA102, and AT88SA10HS devices have a 1-wire communication interface. The make the USART compatible with a 1-wire CryptoAuthentication device, the USART's pins (TX and Rx) are tied together.

Figure 19. USART TXD and RXD pins configured for 1-wire Interfacing

On the AT88CK109BK3, Px2 and Px3 are tied together with a zero ohm resistor (R11). When mounted to the AT88Microbase, pins Px2 and Px3 align with pins (PB3/PD2) and (PB7/PD3). The USART pins, PD2 (RXD) and PD3 (TXD), are effectively tied together with R11 allowing the USART to be compatible with the CryptoAuthentication 1-wire interface.

3.13 In-System Programming

3.13.1 Programming with USB bootloader: DFU (Device Firmware Upgrade)

AT90USB1287 AVR comes with a default factory pre-programmed USB bootloader located in the on-chip boot section of the AT90USB1287. This is the easiest and fastest way to reprogram the device directly over the USB interface. The "Flip" PC side application, available for free on Atmel website, offers a flexible and user friendly interface for reprogramming the application over the USB bus.

The "HWB" push button is used to place the AVR into DFU mode after reset (Refer to AT90USB1287 datasheet section "boot loader support").

The following steps enable the DFU mode:
1. Press and hold "HWB" button
2. Press the "RESET" button
3. Release the "RESETT" button.
4. Release the "HWB" button.

For more information about the USB bootloader and FLIP software, please refer to the 'USB bootloader datasheet' document and 'FLIP User Manual'.

Note: HWBE fuse must be enabled to support DFU.
3.13.2 Programming with AVR JTAG ICE

The AT90USB1287 can be programmed using specific the JTAG link. This sub-section will explain how to connect and use the AVR JTAG ICE.

Note: When the JTAGEN fuse is disabled, the four TAP pins are normal port pins, and the TAP controller is in reset. When the JTAGEN fuse is enabled, the input TAP signals are internally pulled high. This enables the JTAG for Boundary-scan and programming. The AT90USB1287 device is shipped with this fuse programmed.

Figure 20. Connecting AVR JTAGICE mkII to the AT88Microbase

The Flash, EEPROM and all Fuse and Lock Bit options ISP-programmable, can be programmed individually or with the sequential automatic programming option.

Note: See AVR Studio® on-line Help for information.

3.14 Debugging

3.14.1 Debugging with AVR JTAG ICE mkII

Every AT88CK109STK3 can be used for debugging with JTAG ICE MK II.

Connect the JTAG ICE mkII as shown in Figure 20, for debugging help; please refer to AVR Studio® Help information.
When using JTAG ICE MK II for debugging, and as AT90USB1287 parts are factory configured with the higher security level set, a chip erase operation will be performed on the part before debugging. Thus the on-chip flash bootloader will be erased. It can be restored after the debug session using the bootloader hex file available from ATMEL website.

3.15 Test Points

There are 4 test points implemented, these test points are referenced in the full schematics section.

- VCC, AT88CK109BK3
- GND, AT88CK109BK3
- HOST signal pin AT88CK109BK3 INTERCONNECT Header
- CLIENT signal pin AT88CK109BK3 INTERCONNECT Header
## Table 4. Troubleshooting Guide

<table>
<thead>
<tr>
<th>Problem</th>
<th>Reason</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>The blue Power LED is not on.</td>
<td>USB Port of AT88Microbase is not connected to PC.</td>
<td>Connect AT88Microbase USB port to PC's USB port.</td>
</tr>
<tr>
<td>The AVR device cannot be programmed.</td>
<td>The JTAG header is not connected to JTAG programmer.</td>
<td>Connect the JTAG header to the JTAG programmer.</td>
</tr>
<tr>
<td></td>
<td>The memory lock bits are programmed.</td>
<td>Erase the memory before programmed.</td>
</tr>
<tr>
<td></td>
<td>Reset disable fuse is set.</td>
<td>Check reset disable fuse.</td>
</tr>
<tr>
<td></td>
<td>Programming too fast with ISP SPI</td>
<td>Check oscillator settings and make sure it is not set higher than SPI clock</td>
</tr>
<tr>
<td></td>
<td>USB Port of AT88Microbase is not connected to PC (programmed through USB).</td>
<td>Connect AT88Microbase USB port to PC's USB port.</td>
</tr>
<tr>
<td></td>
<td>AT88Microbase is not in DFU mode.</td>
<td>— Press and hold the “HWB” push button.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>— Press the “RESET” push button.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>— Release the “RESET” push button.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>— Release the “HWB” push button.</td>
</tr>
<tr>
<td></td>
<td>The communication medium in FLIP hasn't been selected</td>
<td>From the FLIP menu, select “Settings &gt; Communication &gt; USB”.</td>
</tr>
<tr>
<td>AVR Studio does not detect JTAG or ISP programmer.</td>
<td>JTAG or ISP programmer is not connected or power is off.</td>
<td>Connect JTAG programmer to JTAG header or ISP programmer to ISP header and check power connections.</td>
</tr>
<tr>
<td>FLIP program not working.</td>
<td>AT88Microbase is not in DFU mode.</td>
<td>JTAG to load the bootloader and set (check) the HWBE fuse. Correct fuse settings: Reading fuses address 0 to 2.. 0xDE, 0x99, 0xF3</td>
</tr>
</tbody>
</table>
Section 5
Technical Specifications

- System Unit
  - AT88Microbase
    - Physical Dimensions: L=58 x W=25 x H=12 mm
    - Weight: 9.0g
  - AT88CK109BK3
    - Physical Dimensions: L=74 x W=35 x H=23 mm
    - Weight: 17.5g
  - Assembled Module
    - Physical Dimensions: L=100 x W=35 x H=26 mm
    - Weight: 26.5g

- Operating Conditions
  - USB
    - 4.4V - 5V.25 (100mA)
    - *See Section 3.2 3.3V
  - Supply Current
    - 50mA

- Connections
  - USB Connector: Type-A receptacle
  - USB Communications: Full speed 2.0
Section 6
Technical Support

For technical support, please contact securerf@atmel.com. When emailing or contacting tech support, please do not include any proprietary information you may have input into the device. When requesting technical support, please include the following information:

- Which target AVR device is used (complete part number)
- Target voltage and speed
- Clock source and fuse setting of the AVR
- Programming method (ISP, JTAG or specific Boot-Loader)
- Hardware revisions of the AVR tools, found on the PCB
- Version number of AVR Studio. This can be found in the AVR Studio help menu.
- PC operating system and version/build
- PC processor type and speed
- A detailed description of the problem
On the next pages, the following documents of the AT88CK109STK3 are shown:

- AT88Microbase, revision 2.0
  - Complete Schematic
  - Assembly Drawing
  - Bill of Material
  - Default configuration summary

- AT88CK109BK3, revision 1.0
  - Complete Schematic
  - Assembly Drawing
  - Bill of Material
  - Default configuration summary
Figure 1. AT88Microbase Schematic, 1 of 4
Figure 2. AT88Microbase Schematic, 2 of 4
Figure 3. AT88Microbase Schematic, 3 of 4
Figure 5. AT88Microbase Assembly Drawing, 1 of 2 (Top side)
Figure 6. AT88Microbase Assembly Drawing, 2 of 2 (Bottom side)
## AT88Microbase BOM

<table>
<thead>
<tr>
<th>Qty</th>
<th>Reference</th>
<th>Value</th>
<th>Description</th>
<th>Case</th>
<th>Manufacturer PN</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CAPACITOR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>C125-126</td>
<td>20pF</td>
<td>Ceramic</td>
<td>0603</td>
<td>GRM1885C1H200JA01D</td>
</tr>
<tr>
<td>1</td>
<td>C164</td>
<td>150pF</td>
<td>Ceramic</td>
<td>0603</td>
<td>C1608C0G1H151J</td>
</tr>
<tr>
<td>1</td>
<td>C151</td>
<td>1nF</td>
<td>Ceramic</td>
<td>0603</td>
<td>C0603X7R500-102KNE</td>
</tr>
<tr>
<td>1</td>
<td>C102</td>
<td>10nF</td>
<td>Ceramic</td>
<td>0603</td>
<td>C0603X7R500-103JNE</td>
</tr>
<tr>
<td>1</td>
<td>C163</td>
<td>15nF</td>
<td>Ceramic</td>
<td>0603</td>
<td>ECJ1VB1H153K</td>
</tr>
<tr>
<td>1</td>
<td>C184</td>
<td>220nF</td>
<td>Ceramic</td>
<td>0603</td>
<td>GRM188R71A224KA01D</td>
</tr>
<tr>
<td>5</td>
<td>C117 C119</td>
<td>0.1uF</td>
<td>Ceramic</td>
<td>0603</td>
<td>C0603Y5V250-104ZNE</td>
</tr>
<tr>
<td>1</td>
<td>C121</td>
<td></td>
<td>Ceramic</td>
<td>0603</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>C123-124</td>
<td></td>
<td>Ceramic</td>
<td>0603</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>C101 C103</td>
<td>1uF</td>
<td>Ceramic</td>
<td>0603</td>
<td>C0603Y5V250-105ZNE</td>
</tr>
<tr>
<td>1</td>
<td>C120 C172</td>
<td></td>
<td>Ceramic</td>
<td>0603</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>C118</td>
<td>10uF</td>
<td>Ceramic</td>
<td>0805</td>
<td>C0805X5R6R3-106KNE</td>
</tr>
<tr>
<td></td>
<td>RESISTOR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>R1</td>
<td>0</td>
<td>1/16 W</td>
<td>0603</td>
<td>CR0603-16W-000T</td>
</tr>
<tr>
<td>2</td>
<td>R180-181</td>
<td>22</td>
<td>1/16 W</td>
<td>0603</td>
<td>CR0603-16W-220JT</td>
</tr>
<tr>
<td>3</td>
<td>R3 R6-R7</td>
<td>180</td>
<td>1/16 W</td>
<td>0603</td>
<td>CR0603-16W-181JT</td>
</tr>
<tr>
<td>4</td>
<td>R103-105, R171</td>
<td>825</td>
<td>1/16 W</td>
<td>0603</td>
<td>CRCW0603825RFKEA</td>
</tr>
<tr>
<td>1</td>
<td>R183</td>
<td>1.5K</td>
<td>1/16 W</td>
<td>0603</td>
<td>CR0603-16W-152JT</td>
</tr>
<tr>
<td>1</td>
<td>R144</td>
<td>4.7K</td>
<td>1/16 W</td>
<td>0603</td>
<td>CR0603-16W-472JT</td>
</tr>
<tr>
<td>1</td>
<td>R172</td>
<td>3.92K</td>
<td>1/16 W</td>
<td>0603</td>
<td>ERJ3EK3921V</td>
</tr>
<tr>
<td>2</td>
<td>R151 R184</td>
<td>47K</td>
<td>1/16 W</td>
<td>0603</td>
<td>CRCW060347K0FKEA</td>
</tr>
<tr>
<td>1</td>
<td>R2</td>
<td>DNI</td>
<td>1/16 W</td>
<td>0603</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>R4, R5</td>
<td>0</td>
<td>1/16 W</td>
<td>0402</td>
<td>CR0402-16W-000T</td>
</tr>
<tr>
<td></td>
<td>IC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>IC2</td>
<td></td>
<td>ATMEL AVR</td>
<td>64 PIN QFN</td>
<td>AT90USB1287-64QFN</td>
</tr>
<tr>
<td>1</td>
<td>Y121</td>
<td>16MHz</td>
<td>Crystal</td>
<td>SMD</td>
<td>ABM3B-16.000MHZ-B2-T</td>
</tr>
<tr>
<td>1</td>
<td>U1</td>
<td>3.3V</td>
<td>Regulator</td>
<td>SOT-23-5</td>
<td>MIC5219-3.3YM5 TR</td>
</tr>
<tr>
<td>1</td>
<td>U6</td>
<td></td>
<td>ATMEL CryptoCompanion</td>
<td>8ld SOIC</td>
<td>ATSC018-SU-CM</td>
</tr>
<tr>
<td></td>
<td>DIODE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>LEDP</td>
<td>BLUE</td>
<td>LED</td>
<td>0603</td>
<td>MB1111C-TR</td>
</tr>
<tr>
<td>3</td>
<td>LED1-3</td>
<td>RED</td>
<td>LED</td>
<td>0603</td>
<td>BR1111C-TR</td>
</tr>
<tr>
<td>2</td>
<td>D181-182</td>
<td></td>
<td>ESD Suppressor</td>
<td>0603</td>
<td>PGB1010603MR</td>
</tr>
<tr>
<td>1</td>
<td>D1</td>
<td></td>
<td>Schotkky</td>
<td>SOD-323</td>
<td>NSR1020MW2T1G</td>
</tr>
<tr>
<td>1</td>
<td>D2</td>
<td></td>
<td>Schotkky</td>
<td>SOD-123</td>
<td>MBR0520L</td>
</tr>
<tr>
<td></td>
<td>MISC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>USB</td>
<td>WM17117-ND</td>
<td>TYPE A</td>
<td>USB RT ANG.</td>
<td>48037-0001</td>
</tr>
<tr>
<td>1</td>
<td>L161</td>
<td>-</td>
<td>Ferrit Bead</td>
<td>0603</td>
<td>M0603J601R-10</td>
</tr>
<tr>
<td>1</td>
<td>Q1</td>
<td>NPN</td>
<td>Transistor</td>
<td>SOT23-3</td>
<td>MMBTA42LT1G</td>
</tr>
<tr>
<td>1</td>
<td>H2</td>
<td>0.1&quot; Pitch</td>
<td>JTAG</td>
<td>2x5 Male Header RA</td>
<td>TSW-105-16-L-D-RA</td>
</tr>
<tr>
<td>1</td>
<td>J1</td>
<td>0.1&quot; Pitch</td>
<td>PORT-D Interface</td>
<td>2x5 Male Header</td>
<td>PBC05DAAN</td>
</tr>
<tr>
<td>1</td>
<td>B121</td>
<td>-</td>
<td>Buzzer</td>
<td>SMD</td>
<td>SMT-0540-S-R</td>
</tr>
<tr>
<td>2</td>
<td>B151</td>
<td>-</td>
<td>Push Button</td>
<td>SMD</td>
<td>PTS635SSL25SMTR LFS</td>
</tr>
<tr>
<td>1</td>
<td>K1</td>
<td>-</td>
<td>DPDT switch</td>
<td>SMD</td>
<td>CAS-220TA</td>
</tr>
</tbody>
</table>
Figure 7. AT88CK109BK3 Schematic, 1 of 3
Figure 8. AT88CK109BK3 Schematic, 2 of 3
Figure 10. AT88CK109BK3 Assembly Drawing, 2 of 2 (Bottom side)
<table>
<thead>
<tr>
<th>Qty</th>
<th>Reference</th>
<th>Value</th>
<th>Description</th>
<th>Case</th>
<th>Manufacturer PN</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>CAPACITOR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>C1-2</td>
<td>0.1uF</td>
<td></td>
<td>402</td>
<td>C0402X7R160-104KNE</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>RESISTOR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>R11</td>
<td>0</td>
<td></td>
<td>0603</td>
<td>CR0603-16W-000T</td>
</tr>
<tr>
<td>2</td>
<td>R9-10</td>
<td>180</td>
<td></td>
<td>0603</td>
<td>CR0603-16W-181JT</td>
</tr>
<tr>
<td>4</td>
<td>R1-3, R5</td>
<td>1K</td>
<td></td>
<td>0603</td>
<td>CR0603-16W-1001JT</td>
</tr>
<tr>
<td>2</td>
<td>R7-8</td>
<td>1M</td>
<td></td>
<td>0603</td>
<td>CR0603-16W-105JT</td>
</tr>
<tr>
<td>2</td>
<td>R4 R6</td>
<td>825</td>
<td></td>
<td>0603</td>
<td>CRCW0603825RFKEA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>DIODE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>LED1-2</td>
<td>RED</td>
<td>LED</td>
<td>0603</td>
<td>BR1111C-TR</td>
</tr>
<tr>
<td>2</td>
<td>Q1-2</td>
<td>N-CHANNEL</td>
<td>MOSFET</td>
<td>SC-75</td>
<td>NTA4001NT1G</td>
</tr>
<tr>
<td>1</td>
<td>D1</td>
<td>Diode</td>
<td>Unidirectional TVS</td>
<td>DO-214AC, SMA</td>
<td>SMA6J5.0A-TR</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MISC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>S1-2</td>
<td>CryptoAuthentication</td>
<td>Socket</td>
<td>SOT23-3</td>
<td>499-P36-20</td>
</tr>
<tr>
<td>6</td>
<td>H1-5, Interconnect</td>
<td>2PIN HEADER</td>
<td>VERT</td>
<td>2POS .100 TIN</td>
<td>PBC02DAAN</td>
</tr>
<tr>
<td>1</td>
<td>PORT-D</td>
<td>10 Pin 2x5</td>
<td>VERT</td>
<td>.100 10POS Fem</td>
<td>SSW-105-01-G-D</td>
</tr>
<tr>
<td>2</td>
<td>K1-2</td>
<td>Switch</td>
<td>DPDT</td>
<td>Surface Mount</td>
<td>CAS-220TA</td>
</tr>
<tr>
<td>Headquarters</td>
<td>International</td>
<td>Atmel Europe</td>
<td>Atmel Japan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------</td>
<td>--------------</td>
<td>--------------</td>
<td>------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Atmel Corporation</strong> &lt;br&gt;2325 Orchard Parkway &lt;br&gt;San Jose, CA 95131 &lt;br&gt;USA &lt;br&gt;Tel: 1(408) 441-0311 &lt;br&gt;Fax: 1(408) 487-2600</td>
<td><strong>Atmel Asia</strong> &lt;br&gt;Room 1219 &lt;br&gt;Chinachem Golden Plaza &lt;br&gt;77 Mody Road Tsimshatsui East Kowloon &lt;br&gt;Hong Kong &lt;br&gt;Tel: (852) 2721-9778 &lt;br&gt;Fax: (852) 2722-1369</td>
<td><strong>Le Krebs</strong> &lt;br&gt;8, Rue Jean-Pierre Timbaud &lt;br&gt;BP 309 &lt;br&gt;78054 Saint-Quentin-en-Yvelines Cedex &lt;br&gt;France &lt;br&gt;Tel: (33) 1-30-60-70-00 &lt;br&gt;Fax: (33) 1-30-60-71-11</td>
<td><strong>9F, Tonetsu Shinkawa Bldg.</strong> &lt;br&gt;1-24-8 Shinkawa Chuo-ku, Tokyo 104-0033 Japan &lt;br&gt;Tel: (81) 3-3523-3551 &lt;br&gt;Fax: (81) 3-3523-7581</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Product Contact**

<table>
<thead>
<tr>
<th>Web Site</th>
<th>Technical Support</th>
<th>Sales Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="http://www.atmel.com">www.atmel.com</a></td>
<td><a href="mailto:secureRF@atmel.com">secureRF@atmel.com</a></td>
<td><a href="http://www.atmel.com/contacts">www.atmel.com/contacts</a></td>
</tr>
</tbody>
</table>

**Literature Request**

www.atmel.com/literature

Disclaimer: The information in this document is provided in connection with Atmel products. No license, express or implied, by estoppel or otherwise, to any intellectual property right is granted by this document or in connection with the sale of Atmel products. EXCEPT AS SET FORTH IN ATML’S TERMS AND CONDITIONS OF SALE LOCATED ON ATML’S WEB SITE, ATML ASSUMES NO LIABILITY WHATSOEVER AND DISCLAIMS ANY EXPRESS, IMPLIED OR STATUTORY WARRANTY RELATING TO ITS PRODUCTS INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT. IN NO EVENT SHALL ATML BE LIABLE FOR ANY DIRECT, INDIRECT, CONSEQUENTIAL, PUNITIVE, SPECIAL OR INCIDENTAL DAMAGES (INCLUDING, WITHOUT LIMITATION, DAMAGES FOR LOSS OF PROFITS, BUSINESS INTERRUPTION, OR LOSS OF INFORMATION) ARISING OUT OF THE USE OR INABILITY TO USE THIS DOCUMENT, EVEN IF ATML HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. Atmel makes no representations or warranties with respect to the accuracy or completeness of the contents of this document and reserves the right to make changes to specifications and product descriptions at any time without notice. Atmel does not make any commitment to update the information contained herein. Unless specifically provided otherwise, Atmel products are not suitable for, and shall not be used in, automotive applications. Atmel’s products are not intended, authorized, or warranted for use as components in applications intended to support or sustain life.

© 2009 Atmel Corporation. All rights reserved. Atmel®, Atmel logo and combinations thereof, AVR®, AVR Studio®, CryptoMemory®, and others, are registered trademarks or trademarks of Atmel Corporation or its subsidiaries. Windows® and others are registered trademarks or trademarks of Microsoft Corporation. Other terms and product names may be trademarks of others.